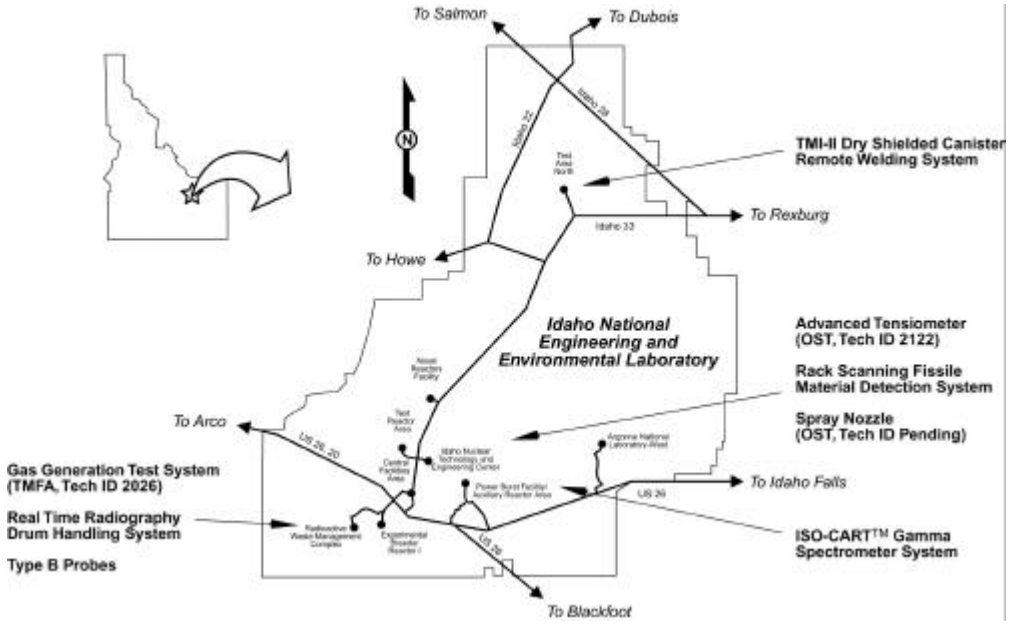
Significant Science & Technology Activities at the INEEL

June 2001



Radioactive Waste Management Complex

Aerial view of the Radioactive Waste Management Complex

Real Time Radiography Drum Handling System Upgrade Improves Characterization Efficiency

According to the 1995 Settlement Agreement with the state of Idaho, 3,100 cubic meters of stored transuranic waste must be shipped out of state by December 31, 2002. Years earlier, the Stored Waste Examination Pilot Plant (SWEPP) was constructed to identify general contents of waste drums. After the plant was built, the Waste Isolation Pilot Plant (WIPP) released its waste acceptance criteria specifying that drums containing liquids would not be accepted. Although instruments at SWEPP were not intended to identify liquids, inspectors needed to determine specifically whether each drum contained liquid. Each drum needed to be jogged for liquid to be visible during x-ray examination. To shake the drums, the system was turned on and off—a practice that contributed to system failure. Engineers observed that the system needed to be redesigned to accommodate the identification of liquids. System operators tasked INEEL's research and development programs to design a more durable, reliable, and efficient material handling system. Engineers not only met the criteria, they quickly developed an upgrade with capabilities exceeding expectations. The operator control console and waste container transport cart were redesigned and replaced to make the system durable enough to handle three drums at a time with the capability of jogging individual drums. To be deployed in July 2001, the **Real Time Radiography Drum Handling System Upgrade** will

reduce the load on the system and increase throughput to an average of four drums an hour. This new drum handling system will aid workers in complying with WIPP's waste acceptance criteria, and will go a long way to help the INEEL meet the shipment of 3,100 cubic meters of transuranic waste out of Idaho.

Benefits:

- Speeds characterization of drum contents, especially for liquids
- Increases system operability, reliability and efficiency
- Increases maintainability and reduces downtime
- Assists in meeting the 3,100 cubic meter shipment milestone

Type B Probes used to investigate subsurface conditions

Nearly 37,000 cubic meters of transuranic waste were disposed of by shallow land burial at the 88-acre Subsurface Disposal Area at the Radioactive Waste Management Complex through 1970. A triparty agreement between DOE-Idaho, EPA Region 10, and the state of Idaho requires characterization and analysis of these wastes. Operations managers at the Complex needed tools that would gather data for such analyses. A suite of six **Type B Probes** was developed to facilitate in situ analysis of wastes and environmental conditions in and around the Subsurface Disposal Area. The six probes include a **visual examination probe**, a **soil moisture probe**, a **soil tension probe**, a **geochemical probe**, a **soil vapor probe**, and a **suction lysimeter**. Each probe was designed for insertion in the ground using the *ResonantSonic Drill Rig* (*Office of Science and Technology, Tech ID 55*) to collect data directly from the surrounding environment. The probes were modified by INEEL engineers to meet the unique demands of a transuranic waste disposal site. Each probe is engineered to collect specific environmental data, such as percent soil moisture, presence and movement of contaminants, groundwater conditions, and actual images of the subsurface. These instrumented probes were used to increase confidence in the field characterization data being gathered under Waste Area Group 7's Remedial Investigation/ Feasibility Study of TRU Pits and Trenches. Four different **Type B Probes** have already been deployed in FY 2001 and the other two probes may be deployed before October 2001.

Benefits:

- Reduces uncertainty in risk assessment calculations that influence decisions that protect people and the environment
- Quantifies water infiltration and potential movement of contaminants
- Protects the environment with minimal intrusion
- Validates the accuracy of characterization data, process knowledge and hot spot locations
- Increases worker safety by reducing exposure and risk

Gas Generation Test System Measures Gas Buildup in Waste Drums (TRU Mixed Waste Focus Area, Tech ID 2026)

INEEL's Transuranic Waste Project managers needed to measure the build-up of gases in contact-handled transuranic waste drums to see if they meet TRUPACT-II safety requirements. Determining actual gas generation rates increases the number of qualified waste drums that can be shipped to the Waste Isolation Pilot Plant in New Mexico. In FY 2000 the **Gas Generation Test System** enabled the project to increase the number of certified waste drums qualified for shipment. All stored contact-handled transuranic waste at the INEEL must be removed from Idaho no later than 2018. This system—comprised of containment canisters, a mobile gas analysis cart, and an automated data management system, allows direct measurement of gas generation rates. This technology makes it possible to meet enforceable milestones to remove stored transuranic waste from Idaho. Based on sampling equipment built by Rocky Flats engineers, INEEL engineers designed and constructed a system for INEEL use by modifying the systems'

safety and sampling capacity and building-in analytical capabilities.

Benefits:

- Plays a critical role in complying with enforceable interim milestone
- Speeds retrieval of analytical data from months to minutes—accelerates schedule
- Measures gas generation rates directly

Test Area North

Aerial view of Test Area North Facilities

TMI-II Dry Shielded Canister Remote Welding System Improves Efficiency and Safety

Radioactive material from the Three Mile Island-II core has been in wet storage at the INEEL's Test Area North facility for many years. The core debris had been stored underwater in fuel canisters. As agreed with the state of Idaho, DOE had to remove the spent fuel from wet storage and place it in a newly constructed and Nuclear Regulatory Commission-permitted dry fuel storage facility by June 1, 2001. Before moving fuel from wet storage, it had to be heated and vacuum dried, then inserted into dry storage canisters. The canisters were "overpacked" in a Nuclear Regulatory Commission-approved shipping cask. Because of the radiation field associated with the TMI fuel and core debris, sealing the fuel with a 66-inch diameter 4.5-inch thick radiological shield plug, and attaching a 1.5-inch thick cover plate presented a major challenge. A welding system with the ability to be remotely operated in a radiation environment was needed. In FY 2001, the **TMI-II Dry Shielded Canister Remote Welding System** met all the technical and safety requirements for a remotely operated and monitored system and was used to weld both the shield plug and the canister cover. This welding system has the unique capacity of two independently operated weld heads—essentially doubling the welding rate.

Benefits:

- Provides cost avoidance of more than $1million
- Increases worker efficiencies and worker safety—eliminates direct worker exposure to radiation
- Accelerates schedule—met enforceable milestone more than one month ahead of schedule

Auxiliary Reactor Area

Aerial view of the Auxiliary Reactor Area

ISO-CART™ Gamma Spectrometer System Identifies Radioactive Isotopes in Contaminated Material

Before removing old sewage piping beneath site ARA-23, surface soils needed to be excavated. To safeguard against the spread of possible contamination and to protect workers, Waste Area Group 5 project managers needed to analyze the soils surrounding the sewer pipes to determine the level of possible contamination. In FY 2001, the **ISO-CART ™ Gamma Spectrometer System** provided the project with an accurate method of performing in situ field gamma measurements in the soil. Using its highly sensitive detectors and analyzer, the ISO-CART ™ takes non-destructive measurements of contaminated material without disturbing the waste. The readings are transmitted to a laptop computer and displayed in either two- or three-dimensional maps and pictures. The adjustable cart positions the detector to obtain accurate readings. Relying on the ISO-CART's ™

user-friendly features, workers can use it in a variety of situations. Because the cart holds the entire detector system and is remotely controlled, it reduces the operator's exposure to contaminated material. The **ISO-CART ™ Gamma Spectrometer System** is designed for reliable operation in harsh environmental conditions and is simple to operate and easy to maneuver.

Benefits:

- Accelerates schedule with faster analytical results
- Reduces worker exposure to contaminated material
- Avoids sampling and disturbing waste and minimizes spread of contamination
- Increases worker safety through remotely-controlled operation

Idaho Nuclear Technology and Engineering Center

Aerial view of the Idaho Nuclear Technology and Engineering Center

Advanced Tensiometer Measures Soil Tension
(Office of Science & Technology, Tech ID 2122)

Project managers needed to measure the seasonal variation of soil moisture in the Big Lost River Area as part of their Remedial Investigation/ Feasibility Study for Waste Area Group 3. Because the water table in this area rises and drops throughout the year, they needed an instrument that would take continuous readings of soil tension in varying temperatures. The **Advanced Tensiometer** was the reliable tool of choice since it measures soil water potential—an indication of how tightly soil holds water. To deploy the instrument, a hole is drilled where soil water potential is going to be measured. The tensiometer is then lowered into the borehole to the desired depth. Once in the ground, water pressure inside the tensiometer equalizes with the water pressure in the surrounding soil. Readings of pressure changes are transmitted to a data logger at the surface. While conventional tensiometers are limited to depths of 10 feet, the **Advanced Tensiometer** has been installed at depths exceeding 100 feet. The design of the tensiometer is simple, low cost, and requires very little maintenance. It has two main parts: a porous cup with a water reservoir and guide tube, and a removable pressure transducer. There are no moving parts and electronic components are serviceable from the surface. The instrument can be continuously operated over a long period of time and is largely unaffected by temperature change. In FY 2001 this instrument was used to improve the reliability of soil water potential measurement in deep underground soils.

Benefits:

- Detects early potential for groundwater contamination at any depth—increasing intervention time
- Detects potential contaminant pathways through the subsurface
- Demonstrates the effectiveness of landfill covers, performs cost-effective long-term monitoring
- Enables the collection of data required to calibrate subsurface contaminant migration models

Rack Scanner Fissile Material Detection System Identifies and Locates Isotopes

After fuel rods from the Wet and Dry Fuel Storage Facility were relocated, there was a possibility that bits of unstable material, known as fissile material, might be left in the racks that held the fuel rods. Spent Nuclear Fuel Program engineers needed a water-tight detection system that would fit in a small space and detect small quantities of a particular radioactive isotope. The **Rack Scanner Fissile Material Detection System** fits in a space as small as six inches in diameter and can detect as small as half a gram of fissile material. The detector identifies Cesium-137, which is an indicator of Uranium-235. The system is tethered to a crane and lowered into a water storage basin where it performs non-destructive analysis of the racks. A computer receives the information transmitted from the gamma assay system and

displays a readout of the type and location of material present. The scanner's remote system allows workers to conduct the entire examination from a safe location. In March 2001, workers at the Wet and Dry Storage Facility used the **Rack Scanner Fissile Material Detection System** to identify the concentration, quantity and exact coordinates of two pieces of suspect material. The information collected by this tool is vital to cleaning up and disposing of the storage racks.

Benefits:

- Detects, identifies and locates specific radioactive isotopes
- Saves time and money on lab results and analysis
- Reduces worker exposure to radiation
- Increases worker safety through remotely-controlled operation

Spray Nozzle Dislodges Sludge and Scale from Tank Walls
(Office of Science & Technology, Tech ID Pending)

Sampling of high-level waste tanks revealed that residual sludge and scale waste was adhering to the inside walls of storage tanks. To meet an agreed-upon waste tank closure milestone, High-Level Waste Program engineers needed an effective and efficient tank washing system that would facilitate transport and removal of loosely bonded waste. Accordingly, the INEEL adapted a **Spray Nozzle** for use on directional and spray ball tank washing systems to dislodge sludge and scale. This nozzle was deployed at tank WM-183 to test the effectiveness of this cleaning method and will be attached to the directional and spray ball washing systems in the future. The INEEL is planning deployment of the spray ball washing system in the summer of 2001 and the directional washing system in FY 2002. The directional system is remotely controlled and maneuvered from a control console that sprays a steady stream of water at its target. The operation can be seen through a camera that moves with the nozzle. The spray ball system automatically sprays multiple streams of water from a two- or four-head spinning nozzle configuration. The camera associated with this washing system is a separate unit that can be pointed in the direction of the spray or in other directions. The spray ball washing system loosens most or all of the residual waste, and if needed, the directional system can be pointed directly at difficult to reach areas such as cooling coils and piping to wash away left-over residues. Together, these tank-washing systems can dislodge virtually all of the loosely bonded sludge and scale from tank walls.

Benefits:

- Enables compliance with RCRA tank closure cleaning criteria and Notice of Noncompliance Consent Order
- Minimizes the generation of secondary waste and spread of contamination
- Increases worker safety through remote-control operation